

ME319 DYNAMICS OF MACHINES

Course Description & Objective:

The course will focus on the study of forces, motion and inertia in machines and performance of machines under dynamic conditions and their analysis.

Course Outcomes:

1. Able to do static and dynamic force analysis on slider crank mechanism but also on other mechanisms.
2. Able to demonstrate the torque analysis on any kind of fly wheel i.e., either on engine flywheel or machine flywheel
3. Able to calculate the brake force analysis on any type of four wheeler
4. Able to perform the experiment and measure the torque acting on a dynamometer
5. Able to conduct experiment on the effect of the gyroscopic torque on any moving/rotating machine
6. Able to demonstrate the working principle of a governor and able to identify different types of governors in actual practice

UNIT - I Static and Dynamic force Analysis:

Introduction, analytical methods to find displacement, velocity and acceleration of the piston, forces acting on connecting rod and crank.

Flywheel: Turning moment diagram, determination of work done and power from turning moment diagram, fluctuation of energy, flywheels.

UNIT - II Brakes:

Block brakes, band brakes, differential band brakes, self locking and self energizing brakes, braking force analysis of a four wheeler.

Gyroscope: Precision motion and its effect on stability of ships, Aeroplanes, and four wheelers.

UNIT - III Governors:

Watt, Porter and Proell governors, spring loaded governors-Hartnell and Hartung governors, terms associated with governor performance - sensitiveness, isochronism and hunting.

Clutches: Uniform pressure and uniform wear, single plate and multiplate clutches, cone clutch.

UNIT - IV Balancing of Rotating Masses:

Balancing of rotating masses, single and multiple masses acting at single and different planes.

Balancing of Reciprocating Masses: primary, secondary balancing, analytical and graphical methods, unbalanced forces and couples, locomotive balancing- hammer blow, swaying couple and tractive efforts, balancing of inline engines.

UNIT - V Longitudinal Vibrations:

Introduction – Definitions – Types of Vibrations – Free Longitudinal Vibrations – Damped Vibrations – Logarithmic Decrement – Forced Vibrations – Vibrations Isolation and Transmissibility.

Transverse & Torsional vibrations – Whirling of Shafts – critical speeds - Free Torsional vibrations - Two rotor systems.

TEXT BOOKS :

1. J.E. Shigley, "Theory of Machines & Mechanisms", 4th ed., Oxford University Press, 2010.
2. R.S.Khurmi and J.K.Gupta, "Theory of Machines", 15th ed., Eurasia Publishing House (Pvt.) Ltd., New Delhi, 2009.

REFERENCE BOOKS :

1. William J. Thomson, "Theory of Vibrations with Applications", 5th ed., Prentice Hall, 1997.
2. J.S. Rao and R.V. Dukkipati, "Mechanism and Machine Theory", 2nd ed., New Age International, 2009.
3. S.S. Rattan, "Theory of Machines", 3rd ed., Tata Mc Graw-Hill Education Pvt. Ltd., New Delhi, 2009.